REMARKS

I. Status of the Claims

Upon entry of the amendments herein, claims 1-104, 138-140 and 148-150 are pending. Applicant notes duplicate numbering of claims 5 and 6 in the original claims as-filed. For clarification, Applicant cancelled herein the second occurrence of the claims numbered 5 and 6, and added that subject matter as new claims 149 and 150, respectively. As such, claims 149 and 150 do not add new subject matter and fall within the previously-elected group of claims. Claims 105-137 and 141-147 are cancelled. Thus, claims 1-24, 31, 45-49, 51-53, 58, 66, 67, 84, 85, 149, and 150 are under examination, and claims 25-30, 32-44, 50, 54-57, 59-65, 68-83, 86-104, 138-140, 143, 144, and 148 have either been cancelled by Applicant, or withdrawn by the Office as directed to non-elected subject matter.

Elected claims 1, 3-7, 9-14, 16-19, 21-24, 31, 45-48, 66, 67, 78-80, 84, and 85 are amended herein. Withdrawn claims 25, 28-30, 32, 34, 37, 40, 43, 44, 59-65, 74-83, and 138 are also amended herein. Claims 74-85 are amended to recite the laser of claim 1 further comprising a catalyst, thus falling within the scope of elected claims. Support for those amendments may be found in the specification, for example, at pages 96-99. *See also* claim 49. Thus, new matter has not been added. Applicant expects that these claims, which are also directed to a laser, will be rejoined and allowed upon allowance of the elected Group I claims.

The claims are amended to address informalities noted by the Examiner. For example, claim 1 is amended to recite "[a] laser comprising . . . a cavity comprising the

laser medium . . . ." Support for that amendment may be found throughout the specification, for example, at pages 63 and 96. Claim 66 is amended to recite "[a] light source comprising . . . a cavity comprising the light-emitting medium, and a power source to produce and maintain the energy level of $H_2(1/p)$ for emission of light." Support for that amendment may be found in the specification, for example, at pages 55-58.

Claims 7 and 9 are amended to correct dependencies with respect to new claim 150. Claims 19, 21, and 22 are amended to correct antecedence with respect to the cavity mirrors and a laser-beam output recited in claim 2. Claim 31 is amended to clarify the laser medium comprising a plasma. *See, e.g.*, specification at pages 96-99.

Accordingly, no new matter is added by any of the amendments herein.

II. Claim Objections

The Office objects to claims 109, 112, 116, and 141 under 37 C.F.R. § 1.75(c) regarding multiple dependencies. Office Action at page 3. Applicant cancelled claims 109, 112, 116, and 141. Accordingly, the objections are moot, and Applicant respectfully requests that the Office withdraw them.

III. Rejection Under 35 U.S.C. § 112, Second Paragraph

The Office rejects independent claims 1, 66, and 145, and dependent claims 2-24, 31, 45-49, 51-53, 58, 67, 84, 85, 105-137, 141, 142, 146, and 147, under 35 U.S.C. § 112, second paragraph, as being "incomplete for omitting essential structural cooperative relationships of elements." Office Action at page 3. The Office

asserts that the claims omit relationships between a laser medium, a cavity, and a power source. *Id.* Applicant respectfully disagrees and traverses the rejection.

To advance prosecution, however, Applicant amended claim 1 to recite "[a] laser comprising . . . a cavity comprising the laser medium," and claim 66 to recite "[a] light source comprising . . . a cavity comprising the light-emitting medium, and a power source to produce and maintain the energy level of $H_2(1/p)$ for emission of light." Applicant also cancelled claim 145. Applicant respectfully submits that the present claims recite the "essential structural cooperative relationships of elements" as required under § 112, second paragraph.

Definiteness of claim language must be analyzed, not in a vacuum, but in light of the application disclosure, the teachings of the prior art, and the claim interpretation that would be given by one of ordinary level of skill in the art at the time the invention was made. M.P.E.P. § 2173.02. The Office fails to consider those factors in its analysis of the present claims. The present specification's teachings and general knowledge in the art allow one of ordinary skill in the art to achieve the claimed invention.

For example, claim 1, as-amended, recites "[a] laser comprising a cavity comprising the laser medium, and a power source to form an inverted population in the energy level of $H_2(1/p)$. It is known in the art that a laser operates by stimulated emission from an inverted population. *See, e.g.*, Applicant's specification at page 34.

The Office asserts that "it is not clear that the claim laser medium comprises only Hydrogen (?) and how the claimed power source forms an inverted population in an energy level of Hydrogen (?)." Office Action at page 3. The present specification

discloses formation of $H_2(1/p)$ recited in the claims at pages 13-32, i.e., by "reacting an ordinary hydrogen atom with a catalyst having a new enthalpy of reaction of about m·27.2 eV where *m* is an integer." Specification at page 13. Further, "[s]ince vibrational levels are on the order of 0.1 eV and rotational levels are on the order of 0.005 eV, lasing typically occurs in the infrared. However, since $H_2(1/p)$ has vibrational and rotational energies that are p^2 times those of the species comprising uncatalyzed atomic hydrogen were p is an integer, lasing in the visible through the extreme ultraviolet is possible." *Id.* at 34.

Pages 63-65 and 96-110 provide further guidance regarding production of the inverted population of $H_2(1/p)$ according to the presently-claimed invention. For example, pages 98-99 provide the following:

> The source of $H_2(1/p)$ may [be] external, or $H_2(1/p)$ may be generated insitu by the catalysis of atomic hydrogen to form $H(1/p)$ that further reacts to form $H_2(1/p)$. The laser medium may be $H_2(1/p)$ or $H_2(1/p)$ may be formed in the cell during laser operation. In the latter case the cell comprises at least one of an rt-plasma reactor, a plasma electrolysis reactor, barrier electrode reactor, RF plasma reactor, pressurized gas energy reactor, gas discharge energy reactor, microwave cell energy reactor, and a combination of a glow discharge cell and a microwave and or RF plasma reactor of the present invention. Each reactor comprises a source of hydrogen; one of a solid, molten, liquid, and gaseous source of catalyst; a vessel containing hydrogen and the catalyst wherein the reaction to form lower energy hydrogen occurs by contact of the hydrogen with the catalyst; and a means for providing the lower-energy hydrogen product $H_2(1/p)$ to the laser cavity to comprise the laser medium.

Also, further guidance can be found throughout the following passages of the as-filed specification:

> This invention relates to a laser based on hydrogen

molecules designated $H_2(1/p)$ wherein the internuclear distance of each is about a reciprocal integer p times that of ordinary H_2. The $H_2(1/p)$ molecules are vibration-rotationally excited and lase with a transition from a vibration-rotational level to another lower-energy-level other than one with a significant Boltzmann population at the cell neutral-gas temperature such as one with both υ and J=0. The lasing medium comprising $H_2(1/p)$ may be supplied from an external source or generated internally or insitu by the catalysis of atomic hydrogen to form $H(1/p)$ that further reacts to form $H_2(1/p)$. The invention comprises a power source that is at least one of an external source and a cell for the catalysis of atomic hydrogen to form novel hydrogen species and/or compositions of matter comprising new forms of hydrogen such as a source of $H_2(1/p)$ and $H_2(1/p)$. The reaction to form and excite $H_2(1/p)$ may be maintained by an electron beam, microwave, or glow discharge plasma of hydrogen and a source of catalyst. The power from the catalysis of hydrogen and external power may create vibration-rotationally excited comprising an inverted population of $H_2(1/p)$ capable of lasing. The $H_2(1/p)$ laser has an application as a light source for photolithography at short wavelengths. Applicant's Specification, at page 3, starting on line 26.

Another objective of the present invention is to create an inverted population of an energy level of a molecule capable of lasing such as a vibration-rotational level of $H_2(1/p)$. Applicant's Specification at page 35, lines 7 to 9.

Another objective of the present invention is to form the inverted population due to at least one of input power and catalysis of atomic hydrogen to lower-energy states. In an embodiment, $H_2(1/p)$ is formed insitu due to the catalysis of atomic hydrogen, the catalysis cell serves as the laser cavity, and an inverted population may be formed due to at least one of catalysis of atomic hydrogen and input power. Applicant's Specification at page 35 lines 18-24.

A light source of the present invention comprises an emitting species, a cell, a power source, and a output window from the cell. The invention may further comprise further optical components to direct or filter the light emitted from the cell. In an embodiment, the light-emitting species comprises

> hydrogen molecules designated $H_2(1/p)$ wherein the internuclear distance of each is about a reciprocal integer p times that of ordinary H_2. The $H_2(1/p)$ molecules are vibration-rotationally excited and emit with a transition from a vibration-rotational level to another lower-energy-level. The vibration-rotational excitation may be by a direct collisional excitation. Alternatively, the excitation may be by an energy exchange with an excited state species such as an excited activator molecule. The direct excitation and the excitation of the activator may be by collision with an energetic particle from a particle beam such as an electron beam or collision with an energetic species accelerated by power input to the cell. The power input to cause energetic species may be at least one of a particle beam such as an electron beam and microwave, high voltage, and RF discharges. Applicant's Specification at page 55 lines 24-43.

Thus, one of ordinary skill in the relevant art would understand how to achieve the inverted population in an energy level of $H_2(1/p)$ recited in Applicant's claims 1 and 66. And a person of ordinary skill in the chemical arts would know how to assemble a laser and/or light source from a cavity, a laser/light-emitting medium, and a power source. "If the claims, read in light of the specification, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the statute (35 U.S.C. § 112, second paragraph) demands no more." M.P.E.P. § 2173.05(a) (*citing Shatterproof Glass Corp. v. Libbey Owens Ford Co.,* 758 F.2d 613, 225 U.S.P.Q. 634 (Fed. Cir. 1985). Accordingly, Applicant submits that this rejection is overcome, and respectfully requests that the rejection be withdrawn by the Office.

IV. Conclusion

Applicant respectfully submits that the rejections under § 112, second paragraph, are overcome by the foregoing amendments and remarks. Accordingly, Applicant respectfully requests that the Office withdraw the rejections and grant the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to Deposit Account No. 06-0916.

Respectfully submitted,

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